



## BCR gene

BCR, RhoGEF and GTPase activating protein

### Normal Function

The *BCR* gene provides instructions for making a protein whose function is not completely understood. Studies show that the BCR protein may act as a GTPase activating protein (GAP). GAPs turn off (inactivate) proteins called GTPases, which play an important role in chemical signaling within cells. Often referred to as molecular switches, GTPases can be turned on and off. They are turned on (active) when they are attached (bound) to a molecule called GTP and are turned off when they are bound to another molecule called GDP. The BCR protein inactivates a GTPase known as Rac1 by stimulating a reaction that turns the attached GTP into GDP. Through this activity, the BCR protein helps regulate the movement (migration) and function of cells.

The BCR protein can also act as a kinase, which is an enzyme that changes the activity of other proteins by adding a cluster of oxygen and phosphorus atoms (a phosphate group) at specific positions. BCR's kinase activity is likely involved in regulating signaling within cells, although its exact role is unclear.

### Health Conditions Related to Genetic Changes

#### chronic myeloid leukemia

A genetic rearrangement (translocation) involving the *BCR* gene causes a type of cancer of blood-forming cells called chronic myeloid leukemia. This slow-growing cancer leads to an overproduction of abnormal white blood cells. Common features of the condition include excessive tiredness (fatigue), fever, weight loss, and an enlarged spleen.

The translocation involved in this condition, written as t(9;22), fuses part of the *ABL1* gene from chromosome 9 with part of the *BCR* gene from chromosome 22, creating an abnormal fusion gene called *BCR-ABL1*. The abnormal chromosome 22, containing a piece of chromosome 9 and the *BCR-ABL1* fusion gene, is commonly called the Philadelphia chromosome. The translocation is acquired during a person's lifetime and is present only in the abnormal blood cells. This type of genetic change, called a somatic mutation, is not inherited.

The protein produced from the abnormal fusion gene, called BCR-ABL1, signals for cells to grow and divide and blocks the self-destruction of cells that are abnormal or unneeded. The BCR-ABL1 protein is always turned on, so growth and division of affected blood cells is uncontrolled, leading to overproduction of the abnormal cells.

The presence of the Philadelphia chromosome provides a target for molecular therapies.

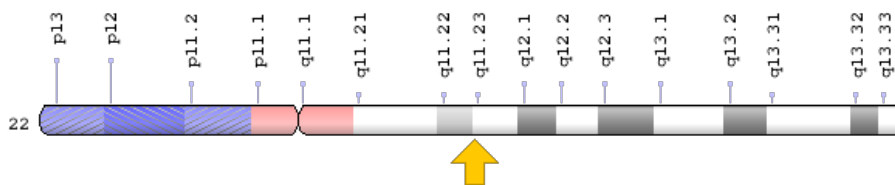
#### other cancers

The *BCR-ABL1* fusion gene (described above) is also involved in fast-growing blood cell cancers called acute leukemias. It has been found in 5 percent of children and up to 30 percent of adults with B-cell acute lymphoblastic leukemia and very rarely in acute myeloid leukemia. As in chronic myeloid leukemia, the BCR-ABL1 protein stimulates overproduction of abnormal white blood cells, leading to cancer. It is likely that the form of blood cancer that develops is influenced by the type of blood cell that acquires the mutation and other genetic changes that occur.

#### **Chromosomal Location**

Cytogenetic Location: 22q11.23, which is the long (q) arm of chromosome 22 at position 11.23

Molecular Location: base pairs 23,180,365 to 23,318,037 on chromosome 22 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

#### **Other Names for This Gene**

- ALL
- BCR/FGFR1 chimera protein
- BCR1
- breakpoint cluster region
- breakpoint cluster region protein isoform 1
- breakpoint cluster region protein isoform 2
- CML
- D22S11
- D22S662

- FGFR1/BCR chimera protein
- PHL
- renal carcinoma antigen NY-REN-26

## **Additional Information & Resources**

### Educational Resources

- An Introduction to Genetic Analysis (seventh edition, 2000): Types of Oncogene Mutations  
[https://www.ncbi.nlm.nih.gov/books/NBK21896/#\\_A3629\\_](https://www.ncbi.nlm.nih.gov/books/NBK21896/#_A3629_)
- Holland-Frei Cancer Medicine (sixth edition, 2003): BCR-ABL as a Therapeutic Target  
[https://www.ncbi.nlm.nih.gov/books/NBK13641/#\\_A13670\\_](https://www.ncbi.nlm.nih.gov/books/NBK13641/#_A13670_)

### Scientific Articles on PubMed

- PubMed  
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28BCR%5BTI%5D%29+OR+%28BCR,+RhoGEF+and+GTPase+activating+protein%5BTI%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5BIa%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D>

### OMIM

- BREAKPOINT CLUSTER REGION  
<http://omim.org/entry/151410>

### Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology  
<http://atlasgeneticsoncology.org/Genes/BCRID55.html>
- ClinVar  
<https://www.ncbi.nlm.nih.gov/clinvar?term=BCR%5Bgene%5D>
- HGNC Gene Family: C2 domain containing  
<http://www.genenames.org/cgi-bin/genefamilies/set/823>
- HGNC Gene Family: Pleckstrin homology domain containing  
<http://www.genenames.org/cgi-bin/genefamilies/set/682>
- HGNC Gene Family: Rho guanine nucleotide exchange factors  
<http://www.genenames.org/cgi-bin/genefamilies/set/722>

- HGNC Gene Symbol Report  
[http://www.genenames.org/cgi-bin/gene\\_symbol\\_report?q=data/hgnc\\_data.php&hgnc\\_id=1014](http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=1014)
- NCBI Gene  
<https://www.ncbi.nlm.nih.gov/gene/613>
- UniProt  
<http://www.uniprot.org/uniprot/P11274>

## Sources for This Summary

- OMIM: BREAKPOINT CLUSTER REGION  
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